

# **VIRTUAL RESOURCES FOR THE IMPROVEMENT OF TEACHING IN THE COURSE OF PORT AND COASTAL ENGINEERING (DEGREE IN CIVIL ENGINEERING)**

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## **Abstract**

Port and Coastal Engineering is a subject included in the third year of the degree in Civil Engineering (Civil Constructions and Hydrology specialty) taught at the Polytechnic School of Algeciras. As this is a subject with a very specific syllabus, there is no textbook (or even appropriate references) that contemplates all the related topics of the whole course. Moreover, there are many students who, for different reasons (repeaters, Erasmus, labour obligations, ...), cannot attend the regular classes. This lack of attendance has been leading to another problem: this kind of students have been leaving the subject for several years. In addition, understanding of the basic concepts becomes even more complicated for Erasmus students enrolled in the subject because of the language barrier. In order to solve this problem, a project of teaching innovation has been launched which consists of the creation of a set of evaluable tasks for the different topics addressed to be performed by the students. In this way, the students are motivated to keep up-to-date the course contents. A comparison of the last year results with those of the preceding five years is provided. Finally, an analysis of the significance of the improvement is also presented.

Keywords: Virtual campus, evaluable tasks, innovation teaching.

## **1 INTRODUCTION**

The university studies, which are currently taught in Spain, were modified a decade ago, for adaptation to the European Higher Education Area (EHEA). The main objective of the EHEA is improving the competitiveness of universities, as well as the quality of teaching. To improve quality, it is necessary to introduce internal and external system evaluation mechanisms [1], as well as a change in teaching methodologies. This change in methodologies should tend to replace part of the theoretical teachings with a more practical education, where new learning methods are included. The evaluation system must integrate both of the above aspects. The most active and practical education makes the students more involved, creating critical minds that allow to improve their training [2].

The use of the new Information and Communication Technologies (ICT), as well as methodologies focused on the autonomous work of students [3], are fundamental in the improvement of teaching and learning [4]. The use of ICT improves the academic performance of those groups of students who receive innovative teaching methods [5]. Any modification in the teaching methodology must be assessed by means of a survey that measures the degree of student satisfaction when using ICT [6] [7].

In recent years, in coastal engineering, audiovisual resources have been developed [8], specialized books [9][10], tutorials to promote self-directed learning [11], use of tools such as GPS and Google Earth [12], methodologies for bibliographic search and promotion of teamwork [13] and teaching methodologies with students from different countries [14]. All this, without forgetting the practical rules of traditional teachings [15].

### **1.1 Students in the Port and Coastal Engineering course**

The Port and Coastal Engineering course is included in the second semester of the third year of the Degree in Civil Engineering at the Higher Polytechnic School of the University of Cadiz in Algeciras (Cadiz, Spain). The degree contains the specialties of civil construction, hydrology and urban transport and services, the course being taught in the first two specialties. The degree in Civil Engineering enables for the exercise of the profession in Spain of Technical Engineer of Public Works. The degree studies have their continuity with the Master of Civil Engineering (Caminos, Canales y Puertos in Spain), also taught in the same center. The proximity of the School with one of the most important ports in Spain and Europe (Port of Algeciras), as well as the long coastline in the province of Cadiz, make the Master have a strong tendency to specialize in the maritime field, reflected for that reason, in an important load of

subjects related to port and coastal engineering. Therefore, the course of Port and Coastal Engineering of the Degree, is fundamental not only for these studies, but also as a basic training for the continuation in the Master.

The course is divided into three blocks: Wave, beaches and maritime works. In the first block we study the theory of waves, refraction, diffraction, reflection, resonance, tides, surf forecast and, wave and weather regimes. The second block is related to coastal dynamics, sediments and beach regenerations. The third block deals with the shape of the ports, maritime works (vertical dikes and embankments), docking and dredging

In the last five years, 57% of the students enrolled failed to pass the subject in the June call.

As it is a subject with a very specific agenda, there are no appropriate simple references that cover the entire range of knowledge necessary to overcome the entire syllabus.

There are numerous students who for different reasons (repeaters, Erasmus grants, labour obligations, ...) cannot regularly attend the classroom teaching, which leads to the abandonment of this for later years. In addition, the understanding of the concepts becomes more complicated for Erasmus students (because the language).

The objective, therefore, of this project is, taking advantage of the existing resources on the virtual campus, the introduction of tasks for each of the blocks of the subject that help students acquire the expected knowledge, so that afterwards, serve to improve the results of previous years.

## 2 METHODOLOGY

To promote student participation, a presentation of the project was made in class at the beginning of the course. Students are motivated so that, by modifying the learning method, they obtain better grades.

The learning method is that students perform a series of exercises on the virtual campus (using the Moodle platform), for each of the subjects of the subject. The questions were of the theoretical-practical type and were designed so that once they are finished, an automatic self-correction is performed. The system responds if the answer is correct or incorrect. In the case of being incorrect, the correct answer is not shown. This allows the student to repeat the exercises (only once), to try to complete the entire questionnaire correctly. The deadline for the realization of the issues was 10 days from the beginning of each of the activities. Once the task is finished, the correct answer is displayed.

These tasks are not mandatory, but recommended, as they offer the opportunity to keep the subject up to date, assimilating the necessary concepts to better understand the following course topics.

Those students who achieved 100% success in all the tasks proposed during the course, obtained a score of two points on the final grade. When they performed partially or incorrectly, they obtained the points equivalent to the percentage of successful tasks were obtained for the final qualification.

The qualification of the students who have participated in the project is calculated as:

$$\text{Grade Course} = 70\% \text{ Final exam} + 20\% \text{ Questions} + 10\% \text{ Practical work}$$

For students, who decided not to participate in the project, the final grade of the course was calculated as:

$$\text{Grade Course} = 90\% \text{ Final exam} + 10\% \text{ Practical work}$$

At the end of the course, students conducted a satisfaction survey on the interest, quality and usefulness of the proposed issues. The survey scoring system was 1 to 5, where 1 was not at all satisfied and 5 was very satisfied. A section was included where changes could be proposed to improve the project.

## 3 RESULTS

For the analysis of the results, the June ratings of the previous five years (2013-2018) have been taken into account, as well as those of the last 2018-2019 academic year. To state that, during these last six years, there has been a continuous decrease in the number of students enrolled in the courses. This decrease is motivated by the lower number of new students in recent years in the Civil Engineering Degree. The average enrolment in the previous five years has been 37 students.

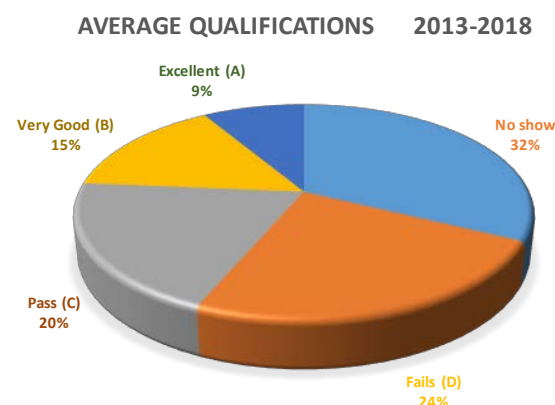
The 2018-2019 course has been formed by 19 students enrolled. Of these students, only 10 have participated in the teaching innovation project. Of the 9 students who have not participated, 22.2% have not passed the final exam and the remaining 77.8% did not even take the exam. Moreover, these students have not usually attended the class. This fact must be taken into account when assessing the results, and thus, this circumstance cannot distort them. Therefore, the analysis will be carried out with the students enrolled in the project, with regular class attendance.

Table 1 shows the number and percentage of students who did not show up, did not pass and passed the final exam from 2013 to 2019.

*Table 1 Number and percentage of students who failed or passed the final exam in the subject of Port and Coastal Engineering from 2013 to 2019.*

Academic year	Enrolled students	No show	% No show	Fails (D)	% Fails (D)	Total Pass	% Total Pass
2013-2014	59	17	28,8	13	22,0	29	49,2
2014-2015	46	15	32,6	13	28,3	18	39,1
2015-2016	44	16	36,4	9	20,5	19	43,2
2016-2017	15	6	40,0	5	33,3	4	26,7
2017-2018	22	6	27,3	5	22,7	11	50,0
<b>Average 2013-2018</b>	<b>37,2</b>	<b>12,0</b>	<b>32,3</b>	<b>9,0</b>	<b>24,2</b>	<b>16,2</b>	<b>43,5</b>
<b>2018-2019</b>	<b>19</b>	<b>9</b>	<b>47,4</b>	<b>4</b>	<b>21,1</b>	<b>6</b>	<b>31,6</b>
<b>2018-2019 In the project</b>	<b>10</b>	<b>2</b>	<b>20,0</b>	<b>2</b>	<b>20,0</b>	<b>6</b>	<b>60,0</b>
<b>2018-2019 Not in the project</b>	<b>9</b>	<b>7</b>	<b>77,8</b>	<b>2</b>	<b>22,2</b>	<b>0</b>	<b>0,0</b>

During the previous five years, 32.3% of the students enrolled did not take the final exam, while the 24.2% who presented did not pass the exam. 43.5% of students passed the final exam. During the current course, with the students who have participated in the project, only 20% of the students did not attend the final exam, and another 20% of the students did not pass the exam. 60% of the students managed to pass the course. None of the students who have not participated in the project have managed to pass the course, with almost 80% of them not taking the final exam.



*Figure 1 Average qualifications before applying the project (2013-2018)*

Figure 1 shows the percentage of students who did not show up or did not pass the course during the previous five years is higher than the percentage of students who passed the course.

Figure 2 shows the average of grades in the 2018-2019 academic year. As you can see the percentage of students who have passed the subject is higher than those who did not pass it. This fact improves the results of approved students of the five previous courses.

### AVERAGE QUALIFICATIONS 2018-2019

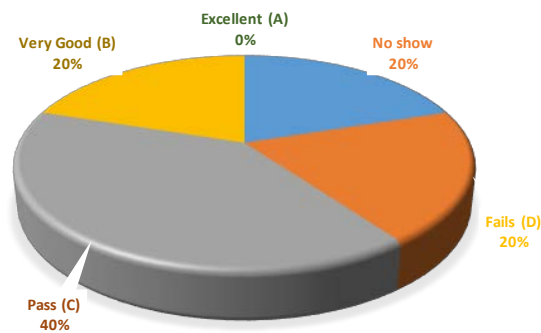


Figure 2 Average qualifications of students who participated in the project after applying the new method (2018-2019)

Table 2 shows the grades of the students from the 2018 to 2019 academic year. As previously mentioned, if we count the total number of students enrolled, the number of students who passed the final exam in the last course (31.6%) it is lower than that of the previous five years (43.5%). On the other hand, if we count in the last year the students who have participated in the project, it reaches 60%. Of the students who have passed the subject, the percentage of students with pass "C" increases (from 45.7 to 66.7), the students with very good "B" slightly decrease (from 34.6% to 33.3 %) and decreases to zero the percentage of excellent "A" (from 19.6% to 0%).

Table 2 Qualifications of the students who passed the final exam in the Port and Coastal Engineering (2013-2019)

Academic year	Enrolled students	% Total Pass	Pass (C)	% Pass (C)	Very Good (B)	% Very Good (B)	Excellent (A)	% Excellent (A)
2013-2014	59	49,2	7	24,1	12	41,4	10	34,5
2014-2015	46	39,1	5	27,8	8	44,4	5	27,8
2015-2016	44	43,2	15	78,9	3	15,8	1	5,3
2016-2017	15	26,7	2	50,0	2	50,0	0	0,0
2017-2018	22	50,0	8	72,7	3	27,3	0	0,0
<b>Average 2013-2018</b>	<b>37,2</b>	<b>43,5</b>	<b>7,4</b>	<b>45,7</b>	<b>5,6</b>	<b>34,6</b>	<b>3,2</b>	<b>19,8</b>
<b>2018-2019</b>	<b>19</b>	<b>31,6</b>	<b>4</b>	<b>66,7</b>	<b>2</b>	<b>33,3</b>	<b>0</b>	<b>0,0</b>
<b>2018-2019 In the project</b>	<b>10</b>	<b>60,0</b>	<b>4</b>	<b>66,7</b>	<b>2</b>	<b>33,3</b>	<b>0</b>	<b>0,0</b>
<b>2018-2019 Not in the project</b>	<b>9</b>	<b>0,0</b>	<b>0</b>	<b>0,0</b>	<b>0</b>	<b>0,0</b>	<b>0</b>	<b>0,0</b>

The survey that was done to the students at the end of the course, was answered by six students. Of these, four had attended more than 80% of classes and two less than 50% of classes. Five of the students scored 5 on the existing notes on the virtual campus and one student scored with 4. On the new tasks proposed in the project five students scored with 5 and one student with 3 points. All students have scored with 5 the problems solved on the platform. In general, all students have liked the course and have highly valued the existing resources on the virtual campus.

## 4 CONCLUSION

Students who have not participated in the project and have not had continuous monitoring in class attendance have not been able to pass the course.

With the application of the methodology included in this project, the percentage of students who have passed the course is higher than the average of the previous five years.

Among the students who have passed the course, the percentage of students with a grade of "C" has increased, keeping the percentage of very good "B" and decreasing the percentage with excellent "A" to zero.

The survey and comments of the students reflect a high degree of satisfaction on the resources available in the course, as well as the new teaching methodology applied.

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